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SULFUR REDUCTION OF ILLINOIS COALS— WASHABILITY STUDIES

R. J. Helfinstine, N. F. Shimp, J. A. Simon, and M. E. Hopkins

Report of Study Phase II, supported in part by U. S. Public Health Service, Department of Health, Education and Welfare Contract No. PH 86-67-206

July 28, 1971

Prepared at the ILLINOIS STATE GEOLOGICAL SURVEY, *Urbana, Illinois*

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The report describes Phase II of an investigation to determine, by gravity separation technique, the extent to which the sulfur content of Illinois coals can be reduced and to study other washability characteristics. Twenty-seven mine samples were obtained, crushed to a top size of 3/8 inch, screened to 3/8 inch x 28 mesh, and separated into several specific gravity fractions which were subsequently analyzed. It was found that only 5 of the 27 samples came from mines that could produce coal with less than 1.5 percent total sulfur, and these 5 samples were from mines with relatively low sulfur content in the raw coal. Coal samples were subjected to the following tests: size analyses, washability, sulfur removal potential, channel sample analyses, ash fusion and Hardgrove grindability.

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JOHN C. FRYE, CHIEF

July 28, 1971

Mr. Larry R. Cramer
Office of Air Programs
Environmental Protection Agency
Research Triangle Park, NC 27711

Re: Contract No. PH 86-67-206

Dear Mr. Cramer:

We are submitting this final report on Phase II, "Sulfur Reduction of Illinois Coals—Washability Studies," completed with support under the above designated contract. The Phase II report includes studies made in the period June 12, 1969, through July 31, 1971, and expands and supplements data presented in the final report on Phase I studies furnished two years ago.

We have appreciated the opportunity to work with you in this effort.

Sincerely yours,

Jack A. Simon

Jack A. Simon for:

Principal Investigators
Roy J. Helfinstine
Neil F. Shimp
Jack A. Simon

cc: Contracting Officer

SULFUR REDUCTION OF ILLINOIS COALS—
WASHABILITY STUDIES

R. J. Helfinstine, N. F. Shimp,
J. A. Simon, and M. E. Hopkins

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Education and Welfare Contract No. PH 86-67-206
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SULFUR REDUCTION OF ILLINOIS COALS--
WASHABILITY STUDIES

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SUMMARY

This report describes Phase II of an investigation to determine, by gravity separation technique, the extent to which the sulfur content of Illinois coals can be reduced and to study other washability characteristics. Twenty-seven mine samples were obtained, crushed to a top size of 3/8 inch, screened to 3/8 inch x 28 mesh, and separated into several specific gravity fractions, which were subsequently analyzed.

It was found that only 5 of the 27 samples came from mines that could produce coal with less than 1.5 percent total sulfur, and these 5 samples were from mines with relatively low sulfur content in the raw coal. (These figures do not represent proportion of production.) The sulfur content of coal from many mines could be reduced 1.5 or more percentage figures--for example, from 3.5 to 2.0 percent. The percentage reduction of total sulfur was also high for many samples, with a maximum reduction of 65 percent with 80 percent float coal recovery. The average reduction was 36 percent with 80 percent recovery.

Washability tests were made on both 10-pound and 100-pound representative splits from 23 samples. The results from these tests with the two quantities exhibited a close correlation. Likewise, a close correlation existed between data from 2-inch diameter core samples and those from column samples obtained from the mines in nearby locations.

The ash fusion and Hardgrove grindability of the 1.60 specific gravity sink fraction (refuse) did not exhibit a consistent variance from those of a channel sample of coal from the same mine. However, the grindabilities of some of the refuse samples were considerably greater than those of the channel samples.

INTRODUCTION AND ANALYSIS OF PROBLEM

When coal is completely burned, all of the sulfur in the coal is released as sulfur dioxide (SO_2), which is normally discharged into the atmosphere. A major objective of many current pollution control projects is the reduction of this SO_2 discharge. An obvious way to reduce the emission is to reduce the sulfur content of the coal being burned.

The possible reductions in sulfur (and ash) of a coal washed in a commercial preparation plant can be estimated after making float-and-sink (washability) tests with samples of the raw coal in a laboratory. As described in more detail in the procedure section, this process is essentially the determination of the percentages and chemical compositions of the coal fractions that float and sink in liquid baths of different specific gravities.

The basic objective of this investigation was to determine the washability characteristics of Illinois coals, with particular emphasis on the quantity, distribution, and varieties (forms) of sulfur in the coals. A report on the first phase of this investigation was submitted to the U. S. Public Health Service on August 10, 1969. During Phase II of this study, washability tests were made on coal samples from most of the Illinois mines not sampled in Phase I. In addition, the possibility of using diamond-drill core samples of a type commonly obtained in exploratory drilling (NX-size core, approximately 2 inches in diameter) for washability tests was studied.

APPARATUS AND PROCEDURES

The equipment used for Phase II was essentially the same as that used for Phase I. The main pieces of equipment were crushers, screeners, sample splitters, and separatory vessels. Appropriate mixtures of perchloroethylene and naphtha were used to make solutions of the desired gravity for the separations.

The Phase I study indicated that the washability characteristics of Illinois coals having a top size of 1 1/2 inches usually did not vary significantly from those obtained with a top size of 3/8 inch. Because of this similarity of results with the two size ranges and since the 3/8-inch top size would allow the use of a smaller quantity of coal for the washability and chemical tests, a 3/8-inch top size was used for all tests described in this report. A bottom size of 28 mesh (Tyler screen series) was selected because 1) it was considered the finest size of Illinois coal that could be readily separated by gravity methods and 2) only a small proportion of the coal would be finer than 28 mesh after crushing to the top size of 3/8 inch.

During Phase I of the investigation, a 1-ton sample of raw coal was obtained from the tipple or pit. It was difficult, however, to obtain a representative sample; therefore, a different method of sampling was used for this phase. The usual sampling procedure during this phase was to cut

an 80-pound column sample from each of three freshly exposed coal faces at separate working areas of a mine or pit. This procedure provided a total sample of 240 pounds per mine or pit. Normal face channel samples, which excluded mineral bands 3/8 inch or more in thickness, also were cut from the same general locations.

The column samples were crushed to a top size of 3/8 inch by a roll crusher and screened at 28 mesh to give 3/8 inch x 28-mesh and 28-mesh x 0 fractions. Chemical analyses, including total sulfur and varieties of sulfur, proximate analysis, free swelling index, Gieseler plasticity, and heating value, were made on representative samples of these two size fractions.

Approximately 100 pounds of the 3/8-inch x 28-mesh coal were used for the gravity separations, which were made "progressively," i.e., the sink fraction from a bath with a lower specific gravity was placed in a bath of higher specific gravity until the desired maximum specific gravity of 1.60 was used. Five different gravity solutions were used for most coal samples. Chemical analyses, which included total sulfur, sulfate sulfur, pyritic sulfur, organic sulfur, and ash, were made on all float coal fractions and on the 1.60 specific gravity sink material. The free swelling index, Gieseler plasticity, and heating value also were determined on the float coal of the lightest gravity. The Hardgrove grindabilities and ash fusion temperatures were determined for the 1.60 sink material by Commercial Testing and Engineering Company, Chicago, Illinois.

One of the objectives of this investigation was to learn whether useful washability data could be obtained with approximately 2-inch diameter diamond-drill cores of coal. Since about a 10-pound sample of coal is obtained from such a core in a 6-foot seam of coal, washability tests were made on 10-pound samples which had been riffled from the large samples of coal used for washability tests.

The tests and chemical analyses made on the face channel samples of coal included proximate analysis, ultimate analysis, free swelling index, Gieseler plasticity, heating value, varieties of sulfur, chlorine, Hardgrove grindability, and ash fusion temperatures. These tests and analyses, except for grindability and ash fusion, were made by the Analytical Chemistry Section of the Illinois State Geological Survey.

Sources of Samples

Twenty-seven mine samples were obtained for Phase II of the investigation. Table 1 lists the samples by general location in Illinois and by seam. Sample 3 was cut from a coal face that had been exposed for an appreciable period and might have been oxidized; hence another sample (No. 14) was obtained from a freshly exposed face at the same mine at a later date. Sample 21 was obtained for comparison with some cores that had been drilled nearby. No channel sample was cut when column sample 21 was taken from the mine because such a sample had been taken during

TABLE 1 - SOURCES OF SAMPLES

Sample	Location in Illinois	Seam
1	Southern	6
2	Northern and western	6
3	Southern	6
4	Southern	6
5	Central	6
6	Northern and western	6
7	Northern and western	6
8	Northern and western	5
9	Southern	Murphysboro
10	Southern	Reynoldsburg
11	Southern	6
12	Northern and western	6
13	Northern and western	4
14	Southern	6
15	Southern	6
16	Southern	5
17	Northern and western	6
18	Southern	Reynoldsburg
19	Southern	Dellwood
20	Southern	5
21	Central	6
22	Central	7
23	Southern	6
24	Southern	6
25	Northern and western	5
26	Southern	—
27	Southwestern	6

the Phase I study. Samples 10 and 18 were obtained from the same mine at different locations and at different times; therefore no channel sample was taken with column sample 10.

Use of Computer

Most of the data obtained from this study were punched on cards, and an IBM 360-75 computer was used for the compilation of many of the tables. In addition, a computer program was developed to give percentages of total sulfur, pyritic sulfur, and ash for any desired percentage of coal recovery.

RESULTS

Size Analyses

The float-and-sink tests were all made on one size range--3/8 inch x 28 mesh, which represented an average of 92 percent of the 3/8-inch x 0 sample. The minimum percentage of 3/8 inch x 28 mesh was 87 with sample 19; the maximum was 94 with sample 25.

Washability Data

The complete data from the float-and-sink tests for the column samples are given in table A in the appendix. Similar data for the core samples are given in table B. The data labeled "calc. (calculated) whole coal" are the data from the washability tests as calculated for 100 percent float (or 100 percent sink), which is equivalent to the original raw coal sample. Since a representative fraction of the raw coal sample was analyzed directly, the raw coal analyses are labeled "anal. (analyzed) whole coal" and appear directly below the calculated whole coal figures for convenient comparisons. In most cases the agreement is excellent.

The suffix S after a sample number refers to data from a 10-pound sample. A suffix C indicates a core sample. All analyses are given on the dry basis.

Sulfur Removal Potential

A stated objective of this investigation was to determine the sulfur content to which Illinois coals could be reduced by gravity separations. Table 2 has been prepared to provide this information for the 27 samples studied in Phase II. It lists the percentages of total sulfur, pyritic sulfur, and ash, at 40, 60, and 80 percent recoveries, with the samples arranged in ascending order of total sulfur percentage. There are four samples (19, 18, 1, and 10) that had less than 1 percent total sulfur at all recovery levels shown. Of these four, only sample 1 was obtained from a mine in current production and with appreciable unmined reserves. Samples 10 and 18 were obtained from one mine at different times and locations within the mine. Sample 19 is from a small local strip mine which has very small reserves.

Sample 24, which was obtained from a large mine in southern Illinois had float coal with less than 1.5 percent total sulfur content at 80 percent recovery. It was the only sample in the 1.0 to 1.5 percent sulfur range.

Table 3 summarizes the data shown in table 2 and indicates that only 41 percent of the coals sampled had less than 2.5 percent sulfur in the float coal fraction with 80 percent recoveries. Because only the impurities within the seam of coal were included in the raw coal samples (i.e., no roof or floor was included), the percentage of ash in a reject of 20 percent (80 percent recovery) was often relatively low.

Percentage of Sulfur Reduction

Although only a small proportion of Illinois coals can be prepared within the sulfur limits proposed by many regulations, a large proportion of Illinois coals can be prepared to give a material reduction in sulfur on both percentage and weight bases. Obviously if a plant burns coal with 2½ percent sulfur in place of one with 5 percent sulfur, the reduction in SO_2 emission will be about 50 percent. Such a substitution would result in SO_2 reduction equivalent (on a weight basis) to that resulting from using a coal containing 1 percent sulfur in place of one containing 3½ percent sulfur.

TABLE 2 - ANALYSES OF TOTAL SULFUR (IN ASCENDING ORDER), PYRITIC SULFUR, AND ASH

40 percent recovery				60 percent recovery				80 percent recovery			
Sample	Sulfur (%)		Ash (%)	Sample	Sulfur (%)		Ash (%)	Sample	Sulfur (%)		Ash (%)
	Total	Pyritic			Total	Pyritic			Total	Pyritic	
19	0.53	0.02	3.0	19	0.53	0.02	3.6	19	0.57	0.07	4.6
18	0.71	0.15	3.5	18	0.71	0.17	4.1	18	0.72	0.19	4.7
10	0.81	0.17	3.4	1	0.80	0.23	3.7	1	0.79	0.22	5.1
1	0.84	0.26	3.2	10	0.85	0.22	4.3	10	0.93	0.31	5.5
24	1.37	0.41	3.1	24	1.41	0.43	3.9	24	1.48	0.50	5.5
11	1.62	0.36	2.9	11	1.74	0.48	4.1	11	1.91	0.65	6.0
16	1.76	0.72	4.5	16	1.86	0.84	5.5	16	2.07	1.08	6.9
9	1.85	0.75	3.6	15	2.04	0.63	3.8	14	2.21	0.73	6.0
15	1.92	0.45	2.1	14	2.06	0.55	4.1	25	2.26	0.42	8.6
14	1.99	0.44	3.0	3	2.16	0.51	4.2	3	2.32	0.72	6.6
3	2.06	0.39	2.9	25	2.23	0.36	7.0	15	2.35	0.95	6.8
20	2.07	0.45	4.5	20	2.24	0.67	5.9	20	2.59	1.04	7.6
4	2.15	0.44	3.5	9	2.24	1.10	5.0	4	2.66	1.06	7.2
25	2.21	0.32	6.0	4	2.32	0.65	4.9	12	2.67	0.70	4.6
7	2.39	0.49	2.8	12	2.49	0.52	3.2	6	2.80	0.87	5.5
12	2.40	0.43	2.4	7	2.55	0.66	3.8	9	2.84	1.67	6.9
2	2.46	0.48	2.2	6	2.57	0.58	3.4	2	2.84	0.88	4.8
6	2.46	0.42	2.4	2	2.58	0.60	3.1	7	2.90	1.01	6.1
22	2.49	0.71	3.0	22	2.68	0.87	4.3	22	2.93	1.13	6.6
23	2.56	0.51	3.1	23	2.71	0.69	4.6	17	2.93	0.66	6.8
17	2.59	0.33	2.9	17	2.75	0.48	4.4	23	2.95	1.02	6.8
13	2.77	0.56	3.5	13	2.88	0.67	4.3	13	3.08	0.85	5.7
8	2.81	0.55	6.1	8	2.91	0.65	6.5	8	3.22	0.96	7.5
21	3.18	0.49	4.1	21	3.16	0.53	4.7	21	3.36	0.79	6.3
5	3.21	0.44	4.2	5	3.32	0.56	5.4	5	3.51	0.81	7.3
26	3.39	1.57	8.4	26	3.68	1.87	10.2	27	4.07	0.90	6.8
27	3.83	0.38	3.7	27	3.85	0.54	4.9	26	4.07	2.31	12.6

TABLE 3 - PERCENTAGES OF SAMPLES WITHIN VARIOUS SULFUR RANGES *

Sulfur range (%)	Percentage of samples		
	80% recovery	60% recovery	40% recovery
0 - 1.0	15	15	15
0 - 1.5	19	19	19
0 - 2.0	22	26	37
0 - 2.5	41	56	70
0 - 3.0	78	85	85
0 - 3.5	89	93	96
0 - 4.0	93	100	100
0 - 4.5	100	100	100

*27 samples tested.

Table 4 has been prepared to show the total and pyritic sulfur reductions that were obtained with the 27 samples described in this report. The greatest percentage of reduction with 80 percent recovery was 65.3 with sample 10. The greatest numerical reduction in total sulfur with 80 percent recovery was from 5.64 percent to 2.66 percent with sample 4. The percentage of sulfur in the raw coal with sample 26 was less than that in the 80 percent float fraction; this is probably caused by a relatively low sulfur content in the shale that was in the sink fraction and a high percentage of finely distributed pyrite that was in the float fraction. The washability data for this coal sample are plotted in fig. 1.

The average reductions in total sulfur with 80 and 40 percent recoveries were 36.1 and 43.4 percent, respectively, for all samples. The average pyritic sulfur reductions were 62.9 and 76.8 with 80 and 40 percent recoveries, respectively.

Small Samples for Washability Tests

Table 5 lists the percentages of total sulfur, pyritic sulfur, and ash for 40, 60, and 80 percent recoveries for the 27 column samples included in this phase of the investigation. Also shown are the corresponding values for the tests made on the small samples (suffix S). The differences between the values given for the large and small samples are usually less than those specified by ASTM for analytical tolerance between laboratories.

Figures 1 and 2 illustrate the similarity of results with the large and small samples. The curves are considered as the best fit for the data obtained with the large samples. The deviations from the curves of the datum points for the small samples are considered minor.

Although the data obtained from the washability tests on 10-pound samples of 3/8-inch x 28-mesh coal were generally satisfactory, the use of more than 10 pounds, if available, is recommended.

TABLE 4 - SULFUR REDUCTIONS AT 80 AND 40 PERCENT RECOVERIES

Sample	Raw coal		80 percent recovery				40 percent recovery			
	Total sulfur (%)	Pyritic sulfur (%)	Total sulfur (%)	Reduction (%)	Pyritic sulfur (%)	Reduction (%)	Total sulfur (%)	Reduction (%)	Pyritic sulfur (%)	Reduction (%)
1	0.84	0.28	0.79	5.4	0.22	19.7	0.84	0.1	0.26	6.9
2	4.33	2.34	2.84	34.3	0.88	62.6	2.46	43.3	0.48	79.6
3	3.90	2.61	2.32	40.5	0.72	72.6	2.06	47.2	0.39	85.2
4	5.04	4.15	2.66	52.8	1.06	74.4	2.15	61.9	0.44	89.4
5	5.10	2.24	3.51	31.1	0.81	64.0	3.21	37.1	0.44	80.2
6	4.46	2.51	2.80	37.3	0.87	65.3	2.46	44.8	0.42	83.1
7	4.67	2.90	2.90	38.0	1.01	65.3	2.39	48.8	0.49	83.2
8	4.61	2.23	3.22	30.2	0.96	57.1	2.81	39.0	0.55	75.3
9	5.41	4.17	2.84	47.5	1.67	60.1	1.85	65.7	0.75	81.9
10	2.08	2.00	0.93	65.3	0.31	84.4	0.81	69.7	0.17	91.4
11	3.46	2.07	1.91	44.8	0.65	68.5	1.62	53.1	0.36	82.4
12	3.72	1.89	2.67	28.3	0.71	62.6	2.40	35.5	0.43	77.4
13	4.58	2.33	3.08	32.7	0.85	63.4	2.77	39.5	0.56	75.8
14	4.00	2.63	2.21	44.9	0.73	72.2	1.99	50.3	0.44	83.4
15	4.15	2.81	2.35	43.3	0.95	66.1	1.92	53.7	0.45	84.1
16	3.42	2.45	2.07	39.4	1.08	55.9	1.76	48.5	0.72	70.5
17	3.96	2.08	2.93	25.9	0.66	68.2	2.59	34.5	0.33	84.2
18	1.49	0.93	0.72	52.0	0.19	79.4	0.71	52.4	0.15	83.4
19	1.36	0.76	0.57	58.0	0.07	91.2	0.53	60.9	0.02	97.7
20	4.00	2.46	2.59	35.3	1.04	57.9	2.07	48.2	0.45	81.7
21	5.48	2.54	3.36	38.7	0.79	69.0	3.18	41.9	0.49	80.9
22	4.73	2.98	2.93	38.2	1.13	62.2	2.49	47.3	0.71	76.3
23	4.60	2.80	2.95	35.8	1.02	63.5	2.56	44.3	0.51	81.9
24	1.95	1.06	1.48	24.3	0.50	53.2	1.37	29.7	0.41	61.4
25	3.08	1.21	2.26	26.7	0.42	64.9	2.21	28.3	0.32	73.4
26	3.72	2.51	4.07	-9.5	2.31	8.1	3.39	8.9	1.57	37.4
27	6.03	2.72	4.07	32.5	0.90	67.1	3.83	36.5	0.38	85.9
Average	3.90	2.28	2.48	36.1	0.83	62.9	2.16	43.4	0.47	76.8

Washability Tests on Core Samples

One set of core and column samples (33C and 21) was obtained precisely as desired. Column sample 21 was cut from a coal face about 65 feet from diamond-drill core sample 33C, which had been drilled from the surface. The data are plotted in fig. 3. The curves drawn are considered as the best fit for the column sample. The plotted points representing the data obtained with the core sample are quite close to the curve. The greatest variance of points from the curve as drawn are the calculated values for the raw coal (100 percent sink or 100 percent float).

Core samples 32C and 34C were taken about 3,000 feet from column sample 21. The data from the washability tests of these two cores are also plotted in fig. 3 and agree with the trend indicated by curves for the large column sample.

(Text continued on page 14.)

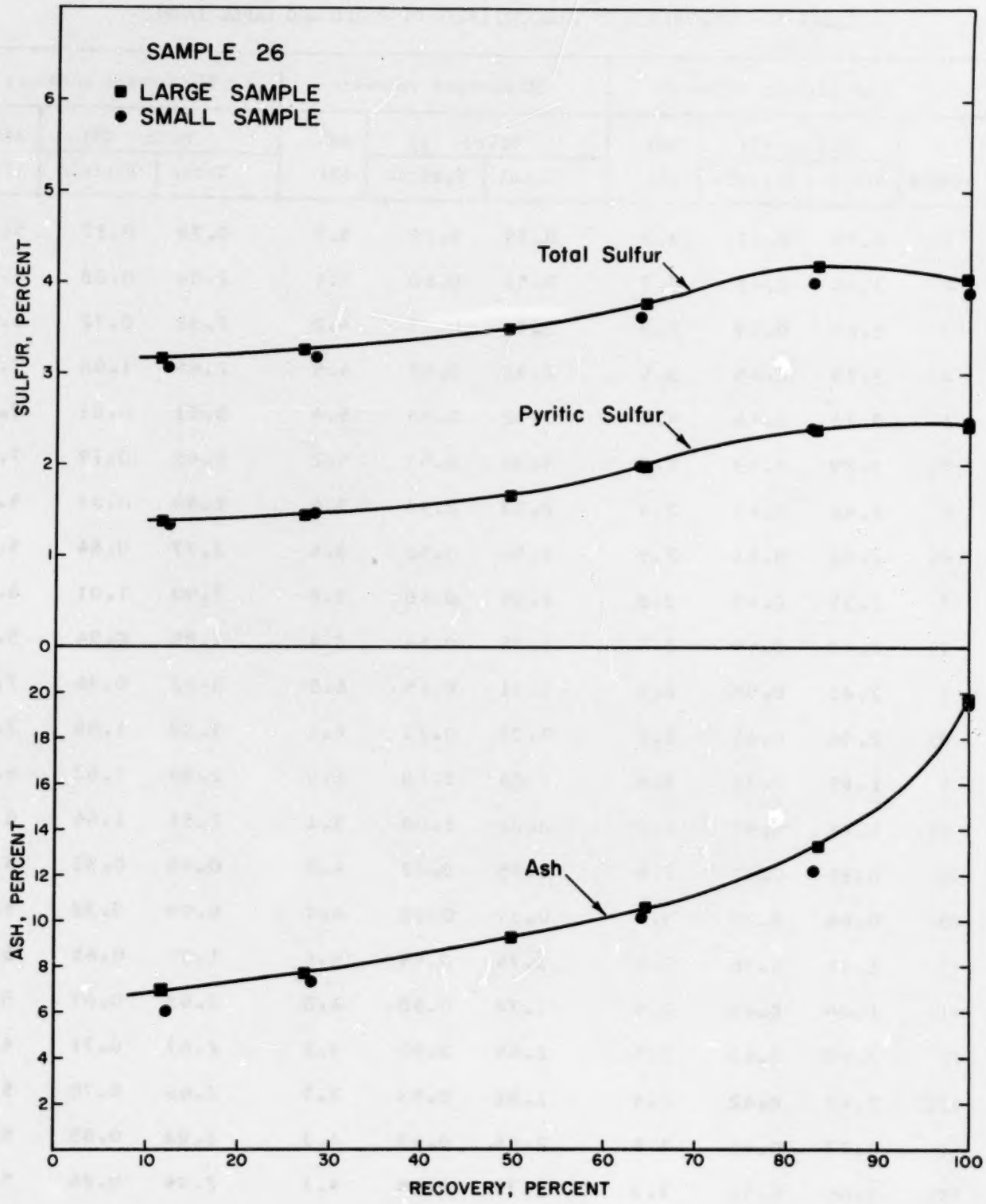

Fig. 1 - Washability characteristics of Sample 26.

TABLE 5 - COMPARISON OF WASHABILITIES OF SMALL AND LARGE SAMPLES

Sample	40 percent recovery			60 percent recovery			80 percent recovery		
	Sulfur (%)		Ash (%)	Sulfur (%)		Ash (%)	Sulfur (%)		Ash (%)
	Total	Pyritic		Total	Pyritic		Total	Pyritic	
1	0.79	0.22	3.2	0.79	0.22	3.7	0.79	0.22	5.1
2	2.46	0.48	2.2	2.58	0.60	3.1	2.84	0.88	4.8
3	2.06	0.39	2.9	2.16	0.51	4.2	2.32	0.72	6.6
4	2.15	0.44	3.5	2.32	0.65	4.9	2.66	1.06	7.2
5	3.21	0.44	4.2	3.32	0.56	5.4	3.51	0.81	7.3
5S	3.29	0.53	4.2	3.30	0.57	5.2	3.45	0.79	7.0
6	2.46	0.42	2.4	2.57	0.58	3.4	2.80	0.87	5.5
6S	2.50	0.51	2.9	2.56	0.58	3.4	2.77	0.84	5.5
7	2.39	0.49	2.8	2.55	0.66	3.8	2.90	1.01	6.1
7S	2.40	0.49	2.5	2.55	0.64	3.4	2.85	0.94	5.4
8	2.81	0.55	6.1	2.91	0.65	6.5	3.22	0.96	7.5
8S	2.96	0.65	5.6	3.03	0.73	6.1	3.30	1.00	7.0
9	1.85	0.75	3.6	2.24	1.10	5.0	2.84	1.67	6.9
9S	1.88	0.89	4.2	2.02	1.09	5.1	2.51	1.64	6.9
10	0.81	0.17	3.4	0.85	0.22	4.3	0.93	0.31	5.5
10S	0.84	0.20	3.4	0.87	0.23	4.1	0.94	0.32	5.4
11	1.62	0.36	2.9	1.74	0.48	4.1	1.91	0.65	6.0
11S	1.64	0.40	2.8	1.78	0.50	4.0	1.95	0.67	5.9
12	2.40	0.43	2.3	2.49	0.52	3.2	2.67	0.71	4.9
12S	2.42	0.42	2.4	2.51	0.53	3.3	2.66	0.70	5.0
13	2.77	0.56	3.5	2.88	0.67	4.3	3.08	0.85	5.7
13S	2.66	0.56	3.3	2.75	0.65	4.1	2.94	0.86	5.5
14	1.99	0.44	3.0	2.06	0.55	4.1	2.21	0.73	6.0
14S	1.93	0.44	3.2	1.99	0.52	3.9	2.15	0.71	6.0
15	1.92	0.45	2.1	2.04	0.63	3.8	2.35	0.95	6.6

TABLE 5 - CONTINUED

Sample	40 percent recovery			60 percent recovery			80 percent recovery		
	Sulfur (%)		Ash	Sulfur (%)		Ash	Sulfur (%)		Ash
	Total	Pyritic	(%)	Total	Pyritic	(%)	Total	Pyritic	(%)
15S	2.08	0.47	3.3	2.13	0.56	4.5	2.39	0.87	6.8
16	1.76	0.72	4.5	1.86	0.84	5.5	2.07	1.08	6.9
16S	1.78	0.76	4.8	1.82	0.83	5.6	1.97	1.04	6.9
17	2.59	0.33	2.9	2.75	0.48	4.4	2.93	0.66	6.8
17S	2.75	0.60	3.9	2.80	0.66	4.6	3.01	0.92	7.4
18	0.71	0.15	3.5	0.71	0.17	4.1	0.72	0.19	4.7
18S	0.70	0.12	3.5	0.70	0.12	4.0	0.70	0.15	4.6
19	0.53	0.02	3.0	0.53	0.02	3.6	0.57	0.07	4.6
19S	0.57	0.08	3.2	0.57	0.08	3.8	0.58	0.08	4.7
20	2.07	0.45	4.5	2.24	0.67	5.9	2.59	1.04	7.6
20S	2.20	0.54	4.6	2.34	0.67	6.0	2.63	1.02	7.7
21	3.14	0.48	4.1	3.16	0.53	4.7	3.36	0.79	6.3
21S	3.38	0.46	4.0	3.43	0.52	4.7	3.62	0.76	6.2
22	2.49	0.71	3.0	2.68	0.87	4.3	2.93	1.13	6.6
22S	2.77	0.89	4.1	2.91	1.02	5.1	3.08	1.22	7.0
23	2.56	0.51	3.1	2.71	0.69	4.5	2.95	1.02	6.8
23S	2.66	0.63	4.2	2.71	0.70	4.8	2.91	0.97	6.9
24	1.37	0.41	3.1	1.41	0.43	3.9	1.48	0.50	5.5
24S	1.25	0.33	2.4	1.32	0.38	3.3	1.39	0.47	5.3
25	2.21	0.32	6.0	2.23	0.36	7.0	2.26	0.42	8.6
25S	2.26	0.34	7.0	2.26	0.34	7.2	2.29	0.41	8.6
26	3.39	1.57	8.4	3.68	1.87	10.2	4.07	2.31	12.6
26S	3.30	1.61	8.0	3.57	1.92	9.9	3.94	2.33	12.3
27	3.81	0.38	3.7	3.85	0.54	4.9	4.07	0.90	6.8
27S	3.82	0.43	4.1	3.82	0.52	5.1	4.02	0.86	7.0

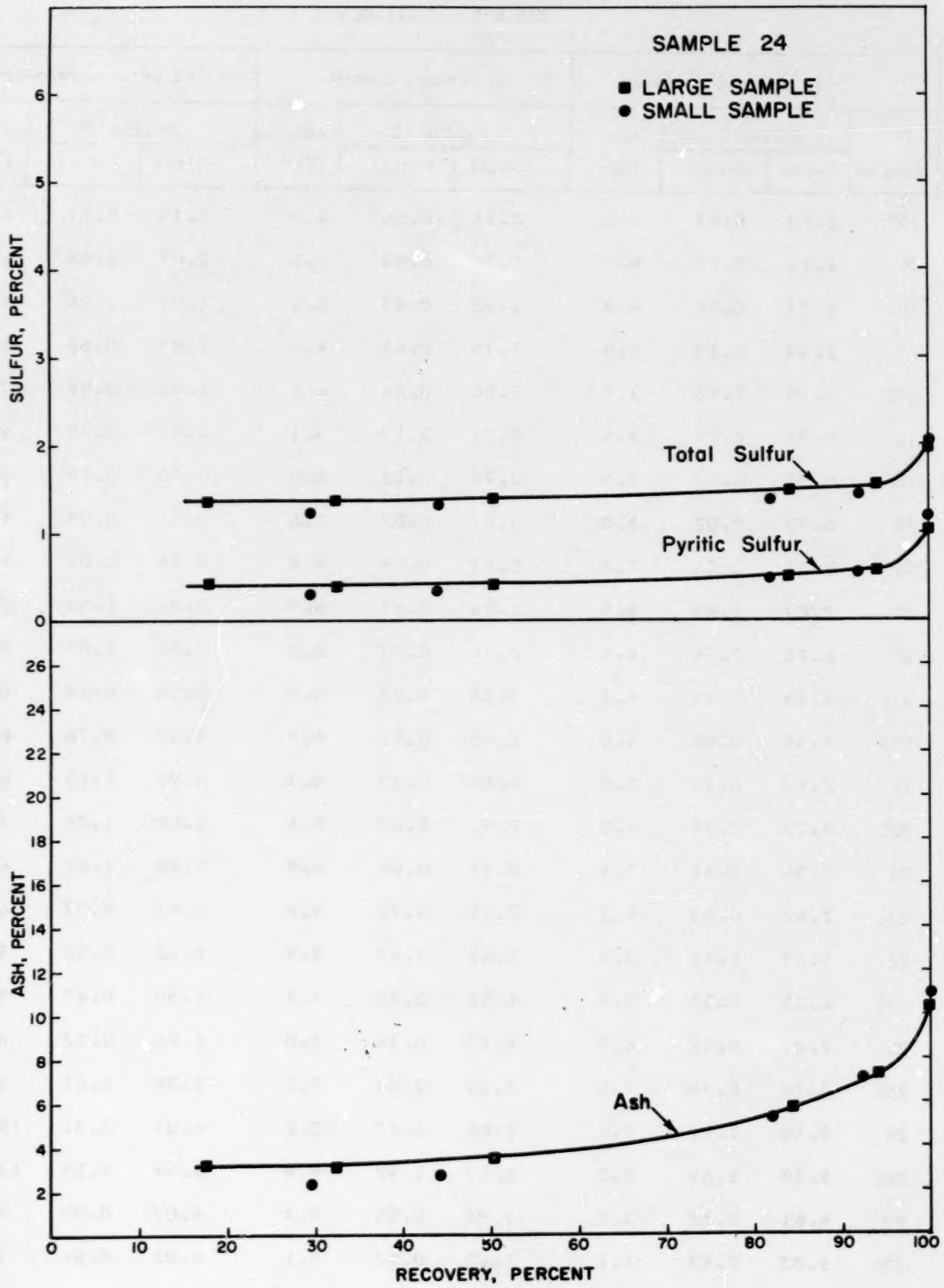

Fig. 2 - Washability characteristics of Sample 24.

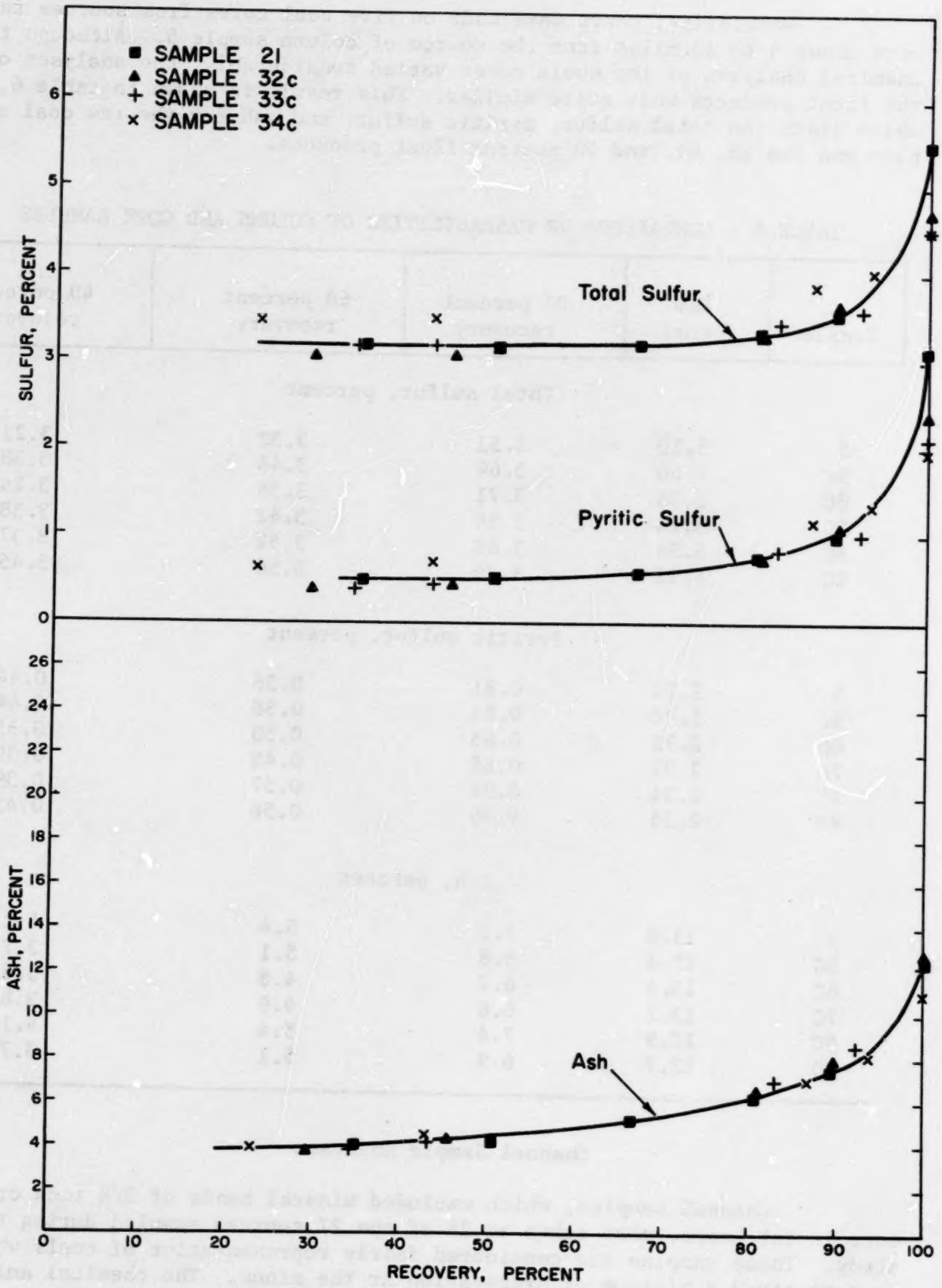

Fig. 3 - Comparison of washabilities of column and core samples.

Washability tests were made on five coal cores from sources that were about 4 to 10 miles from the source of column sample 5. Although the chemical analyses of the whole cores varied considerably, the analyses of the float products were quite similar. This result is shown in table 6, which lists the total sulfur, pyritic sulfur, and ash for the raw coal samples and the 80, 60, and 40 percent float products.

TABLE 6 - COMPARISON OF WASHABILITIES OF COLUMN AND CORE SAMPLES

Sample	Raw coal	80 percent recovery	60 percent recovery	40 percent recovery
		Total sulfur, percent		
5	5.10	3.51	3.32	3.21
5C	4.60	3.69	3.48	3.38
6C	5.56	3.71	3.36	3.26
7C	5.24	3.58	3.42	3.38
8C	5.54	3.88	3.52	3.37
9C	5.12	3.79	3.56	3.45
		Pyritic sulfur, percent		
5	2.24	0.81	0.56	0.44
5C	1.74	0.81	0.58	0.44
6C	2.72	0.85	0.50	0.35
7C	1.77	0.68	0.48	0.39
8C	2.54	0.94	0.57	0.39
9C	2.15	0.79	0.56	0.42
		Ash, percent		
5	13.0	7.3	5.4	4.2
5C	12.4	6.8	5.1	3.7
6C	13.4	6.7	4.8	3.6
7C	13.1	6.6	4.9	3.8
8C	12.9	7.4	5.4	4.1
9C	12.7	6.9	5.1	3.7

Channel Sample Analyses

Channel samples, which excluded mineral bands of 3/8 inch or more in thickness, were taken at 25 of the 27 sources sampled during this study. These samples are considered fairly representative of coals which have received a minimum of preparation at the mines. The chemical analyses for these channel samples are given in table 7.

TABLE 7 - CHEMICAL ANALYSES OF CHANNEL SAMPLES*

Sample	Mois.† (%)	V.M.† (%)	F.C.† (%)	Ash (%)	H† (%)	C† (%)	N† (%)	O† (%)	Sulfur				Chlorine		Heating value (Btu)	Gieseler plasti-city†	Free swelling index
									Sl.† (%)	Pyr.† (%)	Org.† (%)	Total (%)	Total (%)	W.S.† (%)			
1	10.2	36.8	54.3	8.8	4.90	75.13	1.52	8.77	0.0	0.29	0.56	0.85	0.34	0.23	13290	6	5.0
2	15.8	42.0	43.5	14.4	4.63	67.70	1.04	8.51	0.05	1.81	1.82	3.68	0.0	0.0	12109	21	2.5
3	7.3	38.0	49.6	12.4	4.54	69.49	1.27	8.96	0.08	1.79	1.44	3.31	0.10	0.01	12470	317	6.0
4	3.2	37.7	50.3	11.9	4.83	71.96	1.35	6.44	0.04	1.87	1.60	3.51	0.18	0.0	13140	28500	8.0
5	13.7	41.2	44.7	14.1	4.59	66.25	1.23	9.01	0.11	2.27	2.46	4.84	0.17	0.08	12050	4	4.5
6	13.0	39.4	48.6	12.0	4.58	69.97	1.25	8.95	0.33	0.97	1.95	3.25	0.02	0.0	12400	2	2.5
7	18.2	41.4	49.1	9.5	4.97	71.79	1.11	9.43	0.04	1.22	1.94	3.20	0.01	0.01	12810	3	3.0
8	15.8	43.3	44.3	12.5	4.88	68.99	1.14	7.94	0.05	2.33	2.14	4.52	0.01	0.01	12480	25	0.0
9	5.3	37.0	51.8	11.2	4.91	71.21	1.35	6.43	0.05	3.78	1.07	4.90	0.09	0.0	12990	220	6.0
10	No data are available.																
11	8.3	38.3	51.4	10.3	5.08	72.06	1.56	8.61	0.01	1.21	1.15	2.37	0.40	0.10	12980	34	5.5
12	17.0	43.0	45.1	11.9	5.07	68.71	1.11	10.02	0.04	1.20	1.91	3.15	0.04	0.02	12380	2	4.0
13	12.5	45.8	44.2	10.0	5.22	70.61	1.18	9.18	0.03	1.67	2.10	3.80	0.04	0.01	12920	300	4.0
14	6.8	38.3	50.3	11.4	4.88	70.95	1.27	8.14	0.02	2.07	1.26	3.35	0.05	0.02	12869	290	6.5
15	6.4	39.3	47.4	13.3	4.79	69.59	1.36	7.46	0.16	2.11	1.38	3.50	0.14	0.02	12562	240	6.5
16	7.6	37.0	50.8	12.2	4.66	71.23	1.42	7.36	0.04	2.30	0.83	3.17	0.32	0.01	12728	31	6.5
17	16.0	43.3	43.8	12.9	4.91	69.53	1.10	8.02	0.05	1.54	1.96	3.55	0.02	0.02	12455	150	4.5
18	6.7	32.0	61.0	7.1	4.81	77.72	1.43	7.32	0.03	1.10	0.54	1.66	0.12	0.02	13794	120	7.0
19	9.1	35.0	56.7	8.2	4.93	75.43	1.50	8.67	0.10	0.76	0.37	1.23	0.11	0.01	13280	3	1.0
20	5.9	39.5	48.7	11.8	5.03	71.57	1.48	6.00	0.02	2.62	1.51	4.14	0.26	0.04	12947	1100	6.5
21	No data are available.																
22	12.8	46.4	42.5	11.1	5.06	71.06	1.33	7.70	0.02	1.97	1.78	3.77	0.19	0.08	12850	1950	5.5
23	7.3	39.2	47.7	13.2	4.89	69.47	1.29	6.77	0.02	2.81	1.57	4.40	0.13	0.01	12627	2000	7.5
24	9.0	39.0	50.2	10.8	4.77	72.25	1.38	8.43	0.01	1.28	1.01	2.30	0.41	0.14	12889	10	5.5
25	13.9	42.8	42.6	14.7	5.04	68.33	1.20	8.02	0.02	0.92	1.81	2.75	0.02	0.0	12301	8	5.0
26	10.6	43.4	41.3	15.3	5.02	65.30	1.60	8.64	0.10	2.67	1.41	4.18	0.03	0.01	11908	18	4.0
27	18.3	43.6	44.4	11.9	4.90	68.04	1.36	8.52	0.18	1.95	3.09	5.22	0.10	0.08	12254	14	4.5

*Values (except moisture) are given on a dry basis.

†Mois. - moisture; V.M. - volatile matter; F.C. - fixed carbon; H - hydrogen; C - carbon; N - nitrogen; O - oxygen; Sl. - sulfate; Pyr. - pyritic; Org. - organic; W.S. - water soluble; Gieseler plasticity - maximum fluidity, dial divisions per minute.

Ash Fusion and Hardgrove Grindability

The utilization of refuse from a coal cleaning plant in a combustion process designed to recover sulfur is being considered by others. The proper design of this combustion equipment reportedly requires information about ash fusion and grindability of the fuel. To gain some of the information desired, the ash fusion temperatures and Hardgrove grindabilities were obtained for the 1.60 specific gravity sink material and are shown in table 8. Similar data for the channel samples also are included in table 8 for comparison.

No consistent differences were found between the Hardgrove grindability or ash fusion temperatures of the refuse material (1.60 specific gravity sink) and those of the channel samples of coal. The average ash fusion temperatures were about 20° F higher with the refuse material (1.60 specific gravity sink) than with the channel sample. The average Hardgrove grindability was 81.6 with the refuse material and 72.3 with the channel sample. The Hardgrove grindability of some refuse samples, such as sample 7, was considerably higher than the grindability of the corresponding channel coal samples.

TABLE 8 - ASH FUSION AND HARDGROVE GRINDABILITY

Sample	Ash fusion temperatures, °F								Hardgrove Grindability	
	Init. def. temp.*		Softening temp.		Hemispherical temp.		Fluid temp.			
	1.60 s.g. sink*	chan-nel	1.60 s.g. sink*	chan-nel	1.60 s.g. sink*	chan-nel	1.60 s.g. sink*	chan-nel	1.60 s.g. sink*	chan-nel
1	2220	——	2310	——	2330	——	2400	——	89.1	——
2	2030	——	2120	——	2150	——	2250	——	89.0	——
3	1920	1970	2100	2160	2120	2180	2280	2280	68.6	70.7
4	2000	1900	2100	2140	2135	2160	2290	2320	74.3	77.7
5	1920	——	2020	——	2050	——	2150	——	77.9	——
6	1960	2120	2170	2220	2190	2240	2280	2330	92.4	73.3
7	2190	2110	2290	2210	2320	2230	2460	2340	105.2	77.3
8	1890	1940	2050	2030	2070	2050	2170	2150	91.1	79.9
9	2000	1870	2100	2030	2120	2050	2220	2150	78.0	69.4
10	2080	——	2320	——	2340	——	2430	——	102.6	——
11	1900	1960	2000	2090	2020	2110	2120	2200	81.3	77.7
12	2130	2110	2230	2200	2250	2230	2340	2320	84.2	81.9
13	1930	1870	2020	2050	2040	2080	2130	2180	76.3	79.2
14	1900	1950	2000	2040	2020	2060	2120	2150	74.0	58.6
15	1920	2030	2030	2120	2050	2140	2160	2240	65.1	68.7
16	2140	1960	2350	2060	2370	2080	2470	2170	88.9	68.7
17	2040	2040	2150	2140	2170	2160	2280	2250	94.7	72.0
18	1980	1950	2100	2220	2130	2260	2250	2460	82.0	71.4
19	1970	2070	2080	2400	2110	2450	2210	2600	78.6	60.2
20	2180	1950	2310	2050	2340	2080	2470	2230	75.3	73.6
21	1960	——	2060	——	2100	——	2200	——	75.3	——
22	1940	1930	2020	2060	2050	2100	2130	2280	83.9	70.1
23	1960	1980	2100	2100	2130	2130	2250	2260	78.3	73.7
24	2010	2020	2110	2150	2140	2180	2250	2260	92.5	70.1
25	2280	1970	2490	2080	2530	2110	2650	2220	78.3	73.0
26	2150	2000	2350	2150	2380	2180	2600	2270	78.3	70.0
27	1920	1940	2020	2080	2050	2110	2150	2280	73.6	73.6
Average (22 samples)	2014	1984	2144	2126	2170	2153	2285	2270	81.6	72.3

*Init. def. temp. - initial deformation temperature; 1.60 s.g. sink - 1.60 specific gravity sink.

CONCLUSIONS

1. Only a small proportion of Illinois coals can be prepared with a total sulfur content of 1.5 percent or less, and these are all coals which are naturally low in sulfur.

2. The percentage of reduction of the sulfur with many Illinois coals is relatively high, even with a moderate quantity of reject. The maximum reduction of sulfur in cleaned coal reported in this study with 80 percent recovery was 65 percent, and the average reduction was 36 percent.

3. A sulfur reduction of 1.5 or more percentage figures (such as 3.5 to 2.0 percent) was obtained with several samples.

4. The data obtained from washability tests made with 10-pound samples riffled from larger samples of 3/8-inch x 28-mesh coal were quite similar to the data obtained with 100-pound samples.

5. A few comparisons were made between washability tests of diamond-drill cores from exploratory drilling and those of large column samples obtained in a mine from a face near the drill-hole site. These tests, with 3/8-inch x 28-mesh coal, gave similar washability data on the two types of samples.

6. The 1.60 specific gravity sink material did not exhibit consistent differences in grindability or in ash fusion temperatures from those of the column samples.

APPENDIX

TABLE A — FLOAT-AND-SINK DATA FOR COLUMN SAMPLES

SAMPLE 1

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.275	22.0	3.5	0.90	0.32	0.57	78.0	11.6	0.89	0.34	0.54
1.300	50.7	3.5	0.81	0.24	0.57	49.3	16.3	0.97	0.44	0.53
1.320	68.2	4.1	0.80	0.23	0.57	31.8	22.1	1.08	0.58	0.50
1.400	87.0	5.7	0.80	0.23	0.57	13.0	37.5	1.50	1.06	0.44
1.600	93.7	6.8	0.81	0.24	0.56	6.3	54.8	2.11	1.73	0.37
CALC. WHOLE COAL	100.0	9.8	0.89	0.34	0.55					
ANAL. WHOLE COAL	100.0	10.0	0.84	0.28	0.56					

SAMPLE 2

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.260	30.4	2.1	2.44	0.46	1.95	69.6	17.8	5.30	3.56	1.62
1.280	44.0	2.3	2.48	0.50	1.94	56.0	21.4	5.97	4.27	1.55
1.300	57.4	2.9	2.56	0.57	1.94	42.6	26.7	6.95	5.36	1.42
1.400	80.9	4.7	2.85	0.88	1.91	19.1	48.3	11.14	9.98	0.91
1.600	86.3	5.6	2.96	1.00	1.90	13.7	59.7	13.68	12.76	0.62
CALC. WHOLE COAL	100.0	13.0	4.43	2.61	1.72					
ANAL. WHOLE COAL	100.0	12.0	4.33	2.34	1.90					

SAMPLE 3

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.285	25.4	2.4	2.01	0.35	1.65	74.6	18.3	4.24	2.87	1.33
1.300	43.4	3.3	2.08	0.41	1.66	56.6	22.7	4.90	3.63	1.21
1.330	61.0	4.3	2.17	0.52	1.64	39.0	29.9	6.03	4.92	1.04
1.400	76.3	5.8	2.27	0.65	1.60	23.7	41.7	8.21	7.32	0.80
1.600	87.1	7.9	2.40	0.82	1.56	12.9	97.3	12.29	11.76	0.40
CALC. WHOLE COAL	100.0	14.3	3.68	2.23	1.41					
ANAL. WHOLE COAL	100.0	16.5	3.90	2.61	1.26					

SAMPLE 4

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.285	25.8	2.9	2.13	0.41	1.71	74.2	26.6	6.93	5.64	1.26
1.305	46.4	4.0	2.22	0.52	1.68	53.6	34.7	8.70	7.55	1.11
1.335	59.4	4.8	2.29	0.62	1.65	40.6	43.3	10.66	9.65	0.97
1.400	71.5	5.9	2.45	0.82	1.61	28.5	56.9	13.81	12.99	0.77
1.600	78.6	7.2	2.66	1.06	1.58	21.4	69.3	16.82	16.15	0.61
CALC. WHOLE COAL	100.0	20.5	5.69	4.29	1.37					
ANAL. WHOLE COAL	100.0	20.3	5.64	4.15	1.45					

SAMPLE 5

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.270	17.6	3.6	3.18	0.43	2.68	82.4	15.3	5.64	3.16	2.35
1.305	38.1	4.1	3.22	0.47	2.67	61.9	18.9	6.42	4.04	2.25
1.330	52.4	4.9	3.28	0.52	2.68	47.6	22.5	7.32	5.06	2.11
1.400	76.3	6.7	3.42	0.69	2.65	23.7	34.3	10.94	9.07	1.62
1.600	90.0	8.7	3.67	1.01	2.58	10.0	54.8	18.99	17.71	0.86
CALC. WHOLE COAL	100.0	13.3	5.20	2.68	2.41					
ANAL. WHOLE COAL	100.0	13.0	5.10	2.24	2.82					

SAMPLE 5S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.290	35.5	4.0	3.35	0.54	2.78	64.5	17.0	5.69	3.32	2.31
1.325	53.6	4.9	3.32	0.57	2.71	46.4	21.0	6.64	4.37	2.21
1.400	79.5	6.8	3.41	0.75	2.63	20.5	34.0	10.47	8.50	1.87
1.600	91.9	8.6	3.64	1.03	2.58	8.1	55.5	18.61	17.16	1.29
CALC. WHOLE COAL	100.0	12.4	4.86	2.33	2.48					
ANAL. WHOLE COAL	100.0	13.0	5.10	2.24	2.82					

SAMPLE 6

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.250	22.5	2.4	2.45	0.39	2.03	77.5	20.9	4.51	2.89	1.54
1.290	49.0	3.0	2.51	0.50	1.98	51.0	29.8	5.51	4.08	1.34
1.330	66.5	3.8	2.62	0.64	1.94	33.5	42.3	6.87	5.67	1.08
1.400	75.6	4.7	2.73	0.78	1.91	24.4	54.0	8.13	7.12	0.86
1.600	83.9	6.3	2.86	0.96	1.85	16.1	70.9	10.20	9.43	0.60
CALC. WHOLE COAL	100.0	16.7	4.04	2.33	1.65					
ANAL. WHOLE COAL	100.0	18.3	4.46	2.51	1.89					

SAMPLE 6S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.255	27.0	3.4	2.55	0.58	1.93	73.0	21.0	4.77	3.15	1.52
1.300	47.2	3.0	2.51	0.52	1.96	52.8	28.1	5.65	4.19	1.34
1.400	76.9	4.7	2.72	0.77	1.90	23.1	54.7	8.97	8.06	0.76
1.600	84.6	6.4	2.85	0.94	1.85	15.4	70.8	11.41	10.80	0.43
CALC. WHOLE COAL	100.0	16.3	4.17	2.46	1.63					
ANAL. WHOLE COAL	100.0	18.3	4.46	2.51	1.89					

SAMPLE 7

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.250	21.2	2.8	2.41	0.48	1.91	78.8	24.9	4.97	3.49	1.39
1.285	43.3	3.1	2.43	0.53	1.88	56.7	33.4	5.95	4.63	1.21
1.335	65.9	4.2	2.61	0.72	1.86	34.1	51.2	7.94	6.99	0.80
1.400	72.5	4.8	2.72	0.83	1.86	27.5	60.9	8.92	8.19	0.56
1.600	78.9	6.2	2.90	1.01	1.84	21.1	72.9	10.14	9.74	0.22
CALC. WHOLE COAL	100.0	20.2	4.43	2.85	1.50					
ANAL. WHOLE COAL	100.0	22.0	4.67	2.90	1.71					

SAMPLE 7S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.260	30.3	2.3	2.37	0.46	1.90	69.7	24.1	4.97	3.45	1.41
1.285	50.7	3.0	2.47	0.56	1.88	49.3	32.5	5.94	4.58	1.22
1.400	77.6	4.8	2.78	0.86	1.87	22.4	61.6	9.04	8.37	0.48
1.600	82.6	5.9	2.93	1.02	1.85	17.4	72.7	10.13	9.78	0.15
CALC. WHOLE COAL	100.0	17.5	4.18	2.55	1.56					
ANAL. WHOLE COAL	100.0	22.0	4.67	2.90	1.71					

SAMPLE 8

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.260	25.3	6.1	2.85	0.59	2.22	74.7	13.1	4.93	2.78	2.03
1.295	45.6	6.2	2.87	0.61	2.22	54.4	15.7	5.69	3.58	1.96
1.320	62.2	6.6	2.94	0.63	2.22	37.8	19.1	6.81	4.77	1.86
1.400	84.0	7.6	3.19	0.94	2.19	16.0	31.0	10.75	8.96	1.51
1.600	94.4	8.7	3.64	1.38	2.17	5.6	55.2	17.35	16.50	0.52
CALC. WHOLE COAL	100.0	11.3	4.40	2.23	2.08					
ANAL. WHOLE COAL	100.0	10.8	4.61	2.23	2.26					

SAMPLE 8S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.265	24.2	5.6	3.03	0.72	2.27	75.8	12.3	4.94	2.72	2.11
1.305	46.8	5.8	3.00	0.69	2.27	53.2	15.0	5.78	3.59	2.05
1.400	87.5	7.3	3.35	1.06	2.23	12.5	34.3	12.40	10.46	1.62
1.600	94.2	8.1	3.68	1.37	2.23	5.8	52.4	17.49	16.17	0.94
CALC. WHOLE COAL	100.0	10.7	4.48	2.23	2.15					
ANAL. WHOLE COAL	100.0	10.8	4.61	2.23	2.26					

SAMPLE 9

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.285	14.5	2.7	1.63	0.59	1.03	85.5	13.1	5.77	4.67	1.07
1.310	33.7	3.4	1.82	0.73	1.08	66.3	15.7	6.88	5.78	1.05
1.335	52.0	4.4	2.07	0.95	1.11	48.0	19.3	8.54	7.48	1.02
1.400	74.2	6.1	2.58	1.40	1.15	25.8	27.3	12.64	11.79	0.80
1.600	86.4	7.8	3.12	1.94	1.16	13.6	35.6	18.22	17.70	0.48
CALC. WHOLE COAL	100.0	11.6	5.17	4.08	1.06					
ANAL. WHOLE COAL	100.0	12.2	5.41	4.17	1.19					

SAMPLE 9S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.310	38.0	4.1	1.86	0.88	0.97	62.0	16.2	6.69	5.96	0.97
1.335	57.4	5.0	2.08	1.06	1.00	42.6	20.5	8.59	8.03	0.93
1.400	76.7	6.4	2.30	1.50	1.03	23.3	28.6	13.26	12.35	0.77
1.600	90.7	8.3	2.95	2.09	1.05	9.3	44.1	23.38	22.97	0.16
CALC. WHOLE COAL	100.0	11.6	4.85	4.03	0.97					
ANAL. WHOLE COAL	100.0	12.2	5.41	4.17	1.19					

SAMPLE 10

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.290	18.7	2.8	0.80	0.15	0.64	81.3	10.3	3.10	2.51	0.55
1.310	41.6	3.6	0.83	0.19	0.62	58.4	12.7	3.99	3.41	0.53
1.330	65.1	4.6	0.87	0.24	0.62	34.9	17.0	6.04	5.50	0.48
1.400	87.0	5.9	0.94	0.33	0.59	13.0	29.3	14.27	13.76	0.41
1.600	95.0	6.8	1.03	0.42	0.58	5.0	49.4	33.97	33.43	0.37
CALC. WHOLE COAL	100.0	8.9	2.67	2.07	0.57					
ANAL. WHOLE COAL	100.0	8.9	2.68	2.00	0.66					

SAMPLE 10S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.300	36.8	3.3	0.84	0.20	0.63	63.2	11.9	3.56	2.99	0.55
1.325	67.2	4.6	0.89	0.26	0.62	32.8	17.2	5.98	5.44	0.50
1.400	87.9	5.9	0.96	0.34	0.60	12.1	29.4	14.22	13.70	0.46
1.600	95.2	6.7	1.93	0.43	0.59	4.8	48.5	32.90	32.31	0.48
CALC. WHOLE COAL	100.0	8.7	2.56	1.96	0.58					
ANAL. WHOLE COAL	100.0	8.9	2.68	2.00	0.66					

SAMPLE 11

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.290	17.7	2.3	1.53	0.30	1.23	82.3	13.2	3.39	2.19	1.18
1.310	37.5	3.0	1.64	0.38	1.26	62.5	16.3	3.91	2.73	1.15
1.330	56.8	3.8	1.73	0.46	1.26	43.2	21.1	4.81	3.69	1.09
1.400	79.0	5.7	1.85	0.60	1.25	21.0	32.5	7.60	6.57	0.97
1.600	92.4	7.7	2.07	0.82	1.24	7.6	54.6	15.07	14.39	0.55
CALC. WHOLE COAL	100.0	11.3	3.06	1.85	1.19					
ANAL. WHOLE COAL	100.0	11.8	3.46	2.07	1.37					

SAMPLE 11S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.295	26.7	2.4	1.56	0.35	1.20	73.3	14.3	3.59	2.36	1.19
1.320	46.3	3.3	1.71	0.44	1.26	53.7	17.9	4.20	3.02	1.14
1.400	81.9	5.8	1.93	0.65	1.27	18.1	35.1	8.10	7.14	0.85
1.600	92.5	7.5	2.10	0.82	1.26	7.5	55.2	14.67	14.19	0.29
CALC. WHOLE COAL	100.0	11.1	3.05	1.82	1.19					
ANAL. WHOLE COAL	100.0	11.8	3.46	2.07	1.37					

SAMPLE 12

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.250	22.8	2.3	2.38	0.42	1.93	77.2	20.7	4.00	2.42	1.47
1.270	42.2	2.5	2.40	0.43	1.93	57.8	26.7	4.53	3.07	1.31
1.285	56.3	3.0	2.47	0.50	1.93	43.7	34.0	5.13	3.84	1.12
1.400	79.0	4.5	2.66	0.69	1.90	21.0	61.6	7.29	6.75	0.34
1.600	84.0	5.6	2.71	0.76	1.87	16.0	73.7	8.48	8.26	0.01
CALC. WHOLE COAL	100.0	16.5	3.63	1.96	1.58					
ANAL. WHOLE COAL	100.0	19.2	3.72	1.89	1.79					

SAMPLE 12S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.260	31.1	2.3	2.40	0.39	1.99	68.9	22.7	3.79	2.17	1.50
1.290	54.8	3.1	2.48	0.50	1.95	45.2	32.4	4.43	2.97	1.29
1.400	79.3	4.7	2.66	0.68	1.91	20.7	60.9	6.04	5.18	0.65
1.600	84.5	5.8	2.70	0.75	1.88	15.5	73.9	6.95	6.33	0.41
CALC. WHOLE COAL	100.0	16.3	3.36	1.61	1.65					
ANAL. WHOLE COAL	100.0	19.2	3.72	1.89	1.79					

SAMPLE 13

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.260	25.4	3.0	2.73	0.52	2.19	74.6	12.1	4.67	2.50	2.09
1.280	46.3	4.0	2.84	0.63	2.19	53.7	14.7	5.32	3.18	2.06
1.305	63.6	4.3	2.88	0.67	2.18	36.4	19.2	6.44	4.32	2.01
1.400	89.3	6.3	3.19	0.94	2.19	10.7	38.4	12.40	10.81	1.49
1.600	95.2	7.3	3.31	1.07	2.18	4.8	59.0	21.32	20.44	0.83
CALC. WHOLE COAL	100.0	9.8	4.17	2.00	2.12					
ANAL. WHOLE COAL	100.0	10.5	4.58	2.33	2.21					

SAMPLE 13S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.270	33.6	3.2	2.64	0.55	2.06	66.4	12.6	4.72	2.80	1.83
1.300	60.6	4.2	2.77	0.67	2.06	39.4	17.5	5.95	4.17	1.68
1.400	90.1	6.3	3.04	0.97	1.99	9.9	38.2	12.96	11.80	1.14
1.600	95.5	7.1	3.18	1.14	1.98	4.5	58.3	21.98	21.35	0.34
CALC. WHOLE COAL	100.0	9.4	4.02	2.05	1.91					
ANAL. WHOLE COAL	100.0	10.5	4.58	2.33	2.21					

SAMPLE 14

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.290	18.6	2.6	1.99	0.38	1.61	81.4	17.1	4.08	2.87	1.18
1.310	42.3	3.3	2.00	0.46	1.54	57.7	22.6	4.93	3.83	1.06
1.340	61.4	4.1	2.06	0.56	1.51	38.6	30.8	6.28	5.34	0.88
1.400	74.9	5.2	2.15	0.66	1.49	25.1	42.0	8.28	7.59	0.60
1.600	85.9	6.9	2.27	0.81	1.46	14.1	60.3	12.36	12.13	0.09
CALC. WHOLE COAL	100.0	14.4	3.69	2.40	1.26					
ANAL. WHOLE COAL	100.0	14.4	4.00	2.63	1.36					

SAMPLE 14S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.300	35.4	3.2	1.93	0.43	1.50	64.6	20.3	4.61	3.37	1.18
1.330	63.8	4.3	2.02	0.56	1.46	36.2	31.8	6.55	5.46	1.01
1.400	78.2	5.5	2.12	0.68	1.44	21.8	45.6	9.17	8.27	0.78
1.600	87.0	7.1	2.24	0.81	1.41	13.0	62.0	13.19	12.50	0.51
CALC. WHOLE COAL	100.0	14.2	3.66	2.33	1.29					
ANAL. WHOLE COAL	100.0	14.4	4.00	2.63	1.36					

SAMPLE 15

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.300	22.6	1.5	1.96	0.38	1.59	77.4	19.0	4.06	2.89	1.12
1.320	40.3	2.3	1.96	0.48	1.48	59.7	23.6	4.68	3.57	1.05
1.340	53.7	3.2	1.97	0.57	1.40	46.3	28.8	5.45	4.36	1.02
1.400	69.5	4.7	2.14	0.73	1.40	30.5	38.5	6.89	5.96	0.83
1.600	85.8	7.7	2.50	1.09	1.40	14.2	59.4	10.16	9.79	0.19
CALC. WHOLE COAL	100.0	15.0	3.59	2.32	1.22					
ANAL. WHOLE COAL	100.0	16.5	4.15	2.81	1.32					

SAMPLE 15S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.320	42.9	3.4	2.06	0.46	1.59	57.1	23.6	4.99	3.83	1.09
1.340	58.6	4.4	2.15	0.57	1.57	41.4	29.8	5.97	4.95	0.93
1.400	75.8	6.1	2.28	0.75	1.52	24.2	42.4	8.29	7.51	0.63
1.600	86.1	7.8	2.53	1.03	1.49	13.9	58.7	11.16	10.80	0.16
CALC. WHOLE COAL	100.0	14.9	3.73	2.39	1.30					
ANAL. WHOLE COAL	100.0	16.5	4.15	2.81	1.32					

SAMPLE 16

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.310	24.2	3.9	1.75	0.70	1.05	75.8	13.2	3.66	2.76	0.89
1.335	49.8	5.1	1.86	0.82	1.03	50.2	16.8	4.53	3.68	0.83
1.365	73.2	6.3	1.96	0.96	1.00	26.8	23.6	6.59	5.79	0.75
1.400	83.1	7.0	2.04	1.06	0.98	16.9	30.2	8.89	8.14	0.70
1.600	94.6	8.4	2.36	1.39	0.96	5.4	56.1	17.97	17.47	0.40
CALC. WHOLE COAL	100.0	11.0	3.20	2.26	0.93					
ANAL. WHOLE COAL	100.0	11.5	3.42	2.45	0.94					

SAMPLE 16S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.320	33.4	4.6	1.78	0.75	1.02	66.6	14.0	3.63	2.86	0.73
1.340	51.9	5.2	1.82	0.82	0.99	48.1	17.0	4.30	3.59	0.65
1.400	85.1	7.3	1.97	1.06	0.89	14.9	31.5	8.98	8.39	0.46
1.600	94.2	8.2	2.19	1.30	0.87	5.8	54.0	16.39	16.06	0.11
CALC. WHOLE COAL	100.0	10.9	3.01	2.15	0.83					
ANAL. WHOLE COAL	100.0	11.5	3.42	2.45	0.94					

SAMPLE 17

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.225	24.2	2.3	2.49	0.23	2.20	75.8	25.4	4.25	2.25	1.67
1.270	39.4	3.2	2.62	0.35	2.17	60.6	30.5	4.61	2.68	1.55
1.300	58.6	4.1	2.71	0.45	2.13	41.4	41.9	5.39	3.62	1.33
1.400	72.4	5.5	2.85	0.57	2.10	27.6	57.1	6.37	4.89	0.99
1.600	80.0	7.0	2.94	0.68	2.07	20.0	70.8	7.35	6.11	0.69
CALC. WHOLE COAL	100.0	19.8	3.82	1.76	1.80					
ANAL. WHOLE COAL	100.0	21.3	3.96	2.08	1.78					

SAMPLE 17S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.270	39.7	3.9	2.76	0.60	2.12	60.3	32.6	4.81	3.41	1.26
1.305	56.6	4.4	2.77	0.64	2.08	43.4	43.0	5.60	4.45	0.97
1.400	72.6	5.9	2.92	0.80	2.07	27.4	61.8	6.85	6.25	0.37
1.600	78.8	7.3	2.98	0.90	2.03	21.2	73.0	7.77	7.49	0.02
CALC. WHOLE COAL	100.0	21.2	4.00	2.29	1.60					
ANAL. WHOLE COAL	100.0	21.3	3.96	2.08	1.78					

SAMPLE 18

FLOAT FRACTION						SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.290	14.8	2.7	0.69	0.14	0.52	85.2	7.9	1.70	1.21	0.46
1.310	32.3	3.5	0.73	0.17	0.54	67.7	8.9	1.94	1.48	0.44
1.320	49.1	3.8	0.71	0.16	0.53	50.9	10.4	2.37	1.92	0.42
1.400	86.7	4.6	0.69	0.18	0.50	13.3	24.1	7.19	6.77	0.33
1.600	95.5	5.4	0.74	0.23	0.49	4.5	45.5	18.80	18.42	0.20
CALC. WHOLE CCAL	100.0	7.2	1.55	1.05	0.47					
ANAL. WHOLE CCAL	100.0	6.8	1.49	0.93	0.54					

SAMPLE 18S

FLOAT FRACTION						SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.300	27.8	3.2	0.71	0.12	0.58	72.2	8.5	1.69	1.21	0.45
1.315	42.9	3.6	0.71	0.12	0.58	57.1	9.6	1.95	1.49	0.41
1.400	89.6	4.8	0.68	0.15	0.52	10.4	26.7	7.73	7.39	0.21
1.600	95.8	5.3	0.71	0.18	0.50	4.2	47.4	17.61	17.37	0.02
CALC. WHOLE CCAL	100.0	7.0	1.42	0.91	0.48					
ANAL. WHOLE CCAL	100.0	6.8	1.49	0.93	0.54					

SAMPLE 19

FLOAT FRACTION						SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.290	20.4	2.6	0.57	0.04	0.51	79.6	9.1	1.46	0.93	0.45
1.310	44.0	3.3	0.54	0.03	0.49	56.0	11.3	1.86	1.31	0.45
1.330	65.4	3.8	0.54	0.03	0.48	34.6	15.3	2.68	2.09	0.43
1.400	88.0	4.8	0.57	0.06	0.47	12.0	29.5	6.52	5.76	0.42
1.600	96.0	6.0	0.66	0.15	0.47	4.0	50.2	16.19	15.07	0.43
CALC. WHOLE CCAL	100.0	7.8	1.28	0.75	0.47					
ANAL. WHOLE CCAL	100.0	7.8	1.36	0.76	0.52					

SAMPLE 19S

FLOAT FRACTION						SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.290	24.2	3.0	0.64	0.14	0.47	75.8	9.2	1.52	1.01	0.43
1.310	50.3	3.6	0.59	0.09	0.46	49.7	11.9	2.04	1.52	0.41
1.400	90.4	5.0	0.58	0.08	0.46	9.6	33.2	8.17	7.57	0.27
1.600	95.6	5.8	0.61	0.11	0.46	4.4	49.7	16.40	15.78	0.06
CALC. WHOLE CCAL	100.0	7.7	1.31	0.80	0.44					
ANAL. WHOLE COAL	100.0	7.8	1.36	0.76	0.52					

SAMPLE 20

FLOAT FRACTION						SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.275	18.2	3.2	2.04	0.35	1.69	81.8	12.8	4.18	2.69	1.49
1.295	30.9	4.0	2.10	0.44	1.66	69.1	14.2	4.55	3.08	1.46
1.315	49.4	5.2	2.17	0.58	1.59	50.6	16.9	4.38	3.91	1.46
1.400	83.4	7.8	2.54	0.98	1.56	16.6	27.6	10.10	8.73	1.35
1.600	95.2	9.3	3.05	1.51	1.53	4.8	47.4	18.62	17.26	1.33
CALC. WHOLE CCAL	100.0	11.1	3.79	2.27	1.52					
ANAL. WHOLE COAL	100.0	11.8	4.00	2.46	1.53					

SAMPLE 20S

FLOAT FRACTION						SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.300	31.4	4.1	2.17	0.52	1.65	68.6	14.3	4.56	3.24	1.29
1.315	49.3	5.3	2.30	0.63	1.66	50.7	16.8	5.29	4.08	1.15
1.400	85.5	8.1	2.67	1.06	1.59	14.5	28.7	10.57	10.19	0.28
1.600	95.1	9.3	3.01	1.51	1.47	4.9	46.8	19.46	19.31	0.03
CALC. WHOLE COAL	100.0	11.1	3.81	2.38	1.40					
ANAL. WHOLE COAL	100.0	11.8	4.00	2.46	1.53					

SAMPLE 21

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.280	35.1	4.0	3.21	0.49	2.71	64.9	17.1	6.76	4.60	2.14
1.300	50.5	4.4	3.16	0.52	2.64	49.5	20.7	7.91	5.85	2.04
1.325	66.7	5.2	3.21	0.59	2.61	33.3	27.1	10.14	8.30	1.81
1.400	80.7	6.3	3.32	0.75	2.57	19.3	38.4	14.67	13.25	1.38
1.600	89.6	7.5	3.57	1.02	2.54	10.4	55.1	22.24	21.55	0.63
CALC. WHOLE COAL	100.0	12.5	5.51	3.16	2.34					
ANAL. WHOLE COAL	100.0	11.8	5.48	2.54	2.92					

SAMPLE 21S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.275	27.9	3.8	3.41	0.48	2.93	72.1	14.5	5.89	3.37	2.51
1.300	45.5	4.2	3.42	0.50	2.91	54.5	17.6	6.69	4.28	2.38
1.400	83.3	6.3	3.60	0.74	2.85	16.7	37.2	13.20	11.65	1.48
1.600	91.4	7.5	3.85	1.04	2.80	8.6	53.6	19.57	18.69	0.78
CALC. WHOLE COAL	100.0	11.5	5.20	2.56	2.62					
ANAL. WHOLE COAL	100.0	11.8	5.48	2.54	2.92					

SAMPLE 22

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.240	6.9	2.9	2.30	0.67	1.63	93.1	14.0	4.88	3.27	1.58
1.270	16.2	2.7	2.33	0.65	1.68	83.8	15.2	5.16	3.57	1.56
1.285	27.8	2.8	2.40	0.65	1.74	72.2	17.2	5.58	4.03	1.52
1.400	76.6	6.0	2.89	1.09	1.79	23.4	36.7	10.62	9.65	0.90
1.600	89.5	8.1	3.05	1.28	1.76	10.5	56.7	18.74	18.59	0.04
CALC. WHOLE COAL	100.0	13.2	4.70	3.09	1.58					
ANAL. WHOLE COAL	100.0	13.?	4.73	2.98	1.72					

SAMPLE 22S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.250	29.2	3.9	2.70	0.84	1.86	70.8	17.3	5.62	4.03	1.56
1.275	48.0	4.4	2.83	0.94	1.88	52.0	21.7	6.56	5.09	1.43
1.400	85.2	7.6	3.11	1.26	1.84	14.8	46.9	14.32	13.71	0.54
1.600	90.5	8.5	3.20	1.37	1.82	9.5	59.9	19.69	19.57	0.02
CALC. WHOLE COAL	100.0	13.4	4.77	3.10	1.65					
ANAL. WHOLE COAL	100.0	13.3	4.73	2.98	1.72					

SAMPLE 23

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.285	16.5	2.6	2.51	0.46	2.05	83.5	18.6	5.26	3.73	1.50
1.300	33.9	3.1	2.56	0.51	2.05	66.1	22.6	5.96	4.56	1.35
1.325	54.9	4.0	2.66	0.63	2.03	45.1	30.6	7.42	6.30	1.06
1.400	71.7	5.5	2.81	0.84	1.97	28.3	42.6	9.85	9.14	0.63
1.600	81.5	7.2	2.99	1.08	1.91	18.5	54.4	12.77	12.49	0.18
CALC. WHOLE COAL	100.0	16.0	4.80	3.19	1.59					
ANAL. WHOLE COAL	100.0	15.2	4.60	2.80	1.78					

SAMPLE 23S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.295	37.2	4.2	2.66	0.63	2.66	62.8	20.8	5.65	4.04	1.57
1.320	57.7	4.8	2.71	0.70	2.41	42.3	28.1	7.03	5.59	1.37
1.400	76.7	6.2	2.84	0.89	2.26	23.3	42.3	10.12	8.96	1.05
1.600	86.4	8.0	3.01	1.11	2.17	13.6	57.0	14.21	13.33	0.74
CALC. WHOLE COAL	100.0	14.6	4.54	2.77	1.97					
ANAL. WHOLE COAL	100.0	15.2	4.60	2.80	1.78					

SAMPLE 24

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.285	17.9	3.2	1.36	0.44	0.92	82.1	11.9	2.12	1.15	0.96
1.300	32.3	3.1	1.36	0.41	0.95	67.7	13.8	2.28	1.32	0.96
1.315	50.2	3.5	1.39	0.42	0.97	49.8	17.2	2.58	1.63	0.94
1.400	84.0	5.7	1.49	0.50	0.98	16.0	34.5	4.59	3.76	0.82
1.600	94.0	7.3	1.54	0.58	0.96	6.0	56.7	8.89	8.01	0.86
CALC. WHOLE COAL	100.0	10.3	1.98	1.02	0.95					
ANAL. WHOLE COAL	100.0	11.4	1.95	1.06	0.89					

SAMPLE 24S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.290	29.4	2.3	1.21	0.31	0.89	70.6	14.7	2.36	1.54	0.82
1.300	44.0	2.7	1.27	0.34	0.92	56.0	17.6	2.61	1.83	0.78
1.400	81.8	5.3	1.39	0.47	0.91	18.2	36.7	4.87	4.34	0.52
1.600	92.0	7.1	1.44	0.54	0.89	8.0	56.8	8.78	8.49	0.26
CALC. WHOLE COAL	100.0	11.0	2.02	1.18	0.84					
ANAL. WHCLE CCAL	100.0	11.4	1.95	1.06	0.89					

SAMPLE 25

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.275	29.5	5.6	2.19	0.31	1.87	70.5	17.6	3.39	1.71	1.67
1.310	48.3	6.4	2.23	0.35	1.88	51.7	21.2	3.79	2.18	1.60
1.325	62.7	7.2	2.23	0.36	1.85	37.3	25.5	4.40	2.86	1.53
1.400	85.8	9.0	2.24	0.42	1.81	14.2	44.9	7.87	6.58	1.27
1.600	91.3	9.8	2.30	0.50	1.78	8.7	58.3	10.84	9.62	1.19
CALC. WHOLE CCAL	100.0	14.1	3.04	1.29	1.73					
ANAL. WHOLE CCAL	100.0	15.3	3.08	1.21	1.86					

SAMPLE 25S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.275	46.7	7.0	2.27	0.35	1.92	53.3	20.2	3.85	2.17	1.67
1.310	55.0	7.2	2.28	0.36	1.92	45.0	22.5	4.13	2.49	1.63
1.400	86.6	9.2	2.29	0.43	1.85	13.4	45.5	8.46	7.06	1.38
1.600	91.4	10.0	2.36	0.53	1.83	8.6	56.9	11.15	9.78	1.35
CALC. WHOLE CCAL	100.0	14.0	3.11	1.32	1.79					
ANAL. WHOLE COAL	100.0	15.3	3.08	1.21	1.86					

SAMPLE 26

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.290	11.3	6.9	3.16	1.37	1.77	88.7	21.4	4.13	2.55	1.49
1.320	27.1	7.7	3.26	1.44	1.80	72.9	24.2	4.30	2.78	1.42
1.360	49.6	9.3	3.49	1.69	1.76	50.4	30.0	4.53	3.13	1.29
1.400	64.5	10.5	3.78	1.98	1.76	35.5	36.6	4.45	3.21	1.09
1.600	83.5	13.2	4.15	2.39	1.69	16.5	52.6	3.36	2.54	0.65
CALC. WHOLE COAL	100.0	19.7	4.02	2.42	1.52					
ANAL. WHOLE COAL	100.0	20.9	3.72	2.51	1.14					

SAMPLE 26S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.290	12.2	6.1	3.06	1.35	1.69	87.8	21.3	3.99	2.60	1.31
1.320	28.1	7.3	3.18	1.47	1.68	71.9	24.2	4.15	2.83	1.23
1.400	63.8	10.1	3.63	1.99	1.60	36.2	36.0	4.30	3.26	0.93
1.600	82.8	12.8	4.00	2.40	1.55	17.2	51.5	3.29	2.71	0.41
CALC. WHOLE COAL	100.0	19.5	3.88	2.45	1.36					
ANAL. WHOLE COAL	100.0	20.9	3.72	2.51	1.14					

SAMPLE 27

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.276	26.4	3.2	3.92	0.38	3.37	73.6	16.3	6.68	4.03	2.48
1.310	49.6	4.5	3.87	0.49	3.22	50.4	21.1	8.00	5.61	2.22
1.348	69.0	5.5	3.90	0.65	3.09	31.0	29.2	10.52	8.45	1.88
1.400	80.9	6.8	4.01	0.84	3.01	19.1	38.6	14.18	12.51	1.48
1.600	90.8	8.4	4.33	1.23	2.93	9.2	57.1	21.94	21.21	0.59
CALC. WHOLE COAL	100.0	12.8	5.95	3.07	2.72					
ANAL. WHOLE COAL	100.0	13.4	6.03	2.72	3.09					

SAMPLE 27S

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.280	34.5	4.0	3.93	0.44	3.35	65.5	16.8	6.37	3.86	2.44
1.315	56.0	4.9	3.85	0.53	3.23	44.0	21.9	7.66	5.42	2.15
1.400	82.0	7.1	3.99	0.83	3.08	18.0	36.4	12.53	11.10	1.26
1.600	92.0	8.7	4.31	1.23	2.99	8.0	55.5	19.58	19.35	0.03
CALC. WHOLE COAL	100.0	12.4	5.53	2.68	2.75					
ANAL. WHOLE COAL	100.0	13.4	6.03	2.72	3.09					

TABLE B — FLOAT-AND-SINK DATA FOR CORE SAMPLES

SAMPLE 5C

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.280	16.1	2.5	3.37	0.38	2.96	83.9	13.6	4.93	2.21	2.57
1.310	41.0	4.0	3.42	0.49	2.89	59.0	17.3	5.55	2.91	2.46
1.330	60.3	5.0	3.48	0.58	2.85	39.7	22.2	6.50	3.94	2.31
1.400	82.1	6.8	3.66	0.78	2.79	17.9	35.1	9.36	7.11	1.93
1.600	92.6	8.3	3.92	1.05	2.73	7.4	56.0	14.20	12.76	1.37
CALC. WHOLE COAL	100.0	11.8	4.68	1.92	2.63					
ANAL. WHOLE COAL	100.0	12.4	4.60	1.74	2.69					

SAMPLE 6C

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.280	23.1	3.1	3.35	0.35	2.97	76.9	15.7	6.35	3.65	2.53
1.310	45.0	4.2	3.45	0.44	2.97	55.0	19.9	7.47	4.90	2.36
1.330	62.7	5.3	3.56	0.55	2.95	37.3	25.5	9.19	6.82	2.10
1.400	78.9	6.5	3.75	0.77	2.90	21.1	36.3	12.80	10.82	1.62
1.600	90.8	8.3	4.12	1.17	2.83	9.2	57.3	20.85	19.86	0.67
CALC. WHOLE COAL	100.0	12.8	5.66	2.89	2.63					
ANAL. WHOLE COAL	100.0	13.4	5.56	2.72	2.69					

SAMPLE 7C

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.275	20.1	3.2	3.43	0.39	2.99	79.9	14.1	5.08	2.40	2.51
1.300	41.1	4.1	3.42	0.44	2.92	58.9	17.3	5.67	3.09	2.39
1.320	63.4	5.1	3.43	0.49	2.87	36.6	23.6	7.03	4.60	2.16
1.400	83.3	6.7	3.56	0.66	2.80	16.7	37.8	10.67	8.66	1.63
1.600	92.3	8.1	3.77	0.90	2.75	7.7	56.8	16.40	15.18	0.86
CALC. WHOLE COAL	100.0	11.9	4.74	2.00	2.61					
ANAL. WHOLE COAL	100.0	13.1	5.24	2.27	2.77					

SAMPLE 8C

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.280	20.4	3.3	3.40	0.38	2.97	79.6	15.6	6.05	3.28	2.50
1.310	42.0	4.3	3.44	0.46	2.91	58.0	19.5	7.01	4.29	2.37
1.330	60.3	5.5	3.54	0.57	2.89	39.7	24.7	8.51	5.89	2.16
1.400	77.1	6.8	3.71	0.78	2.81	22.9	34.1	11.58	9.10	1.88
1.600	91.0	8.8	4.23	1.27	2.75	9.0	56.6	18.51	16.97	1.05
CALC. WHOLE COAL	100.0	13.1	5.51	2.68	2.60					
ANAL. WHOLE COAL	100.0	12.9	5.54	2.54	2.76					

SAMPLE 9C

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
2.750	21.2	2.9	3.41	0.35	3.02	78.8	15.1	5.50	2.63	2.63
1.305	42.9	4.1	3.52	0.49	2.97	57.1	18.8	6.21	3.39	2.51
1.330	61.6	5.2	3.57	0.57	2.94	38.4	24.3	7.44	4.68	2.34
1.400	79.1	6.6	3.69	0.70	2.90	20.9	35.1	10.23	7.63	2.00
1.600	91.3	8.4	4.01	1.01	2.84	8.7	55.5	16.03	14.09	1.38
CALC. WHOLE COAL	100.0	12.5	5.06	2.15	2.71					
ANAL. WHOLE COAL	100.0	12.7	5.14	2.17	2.51					

SAMPLE 32C

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.280	29.5	3.7	3.06	0.37	2.69	70.5	16.4	5.41	3.22	2.14
1.300	45.7	4.3	3.07	0.43	2.64	54.3	19.6	6.10	4.03	2.02
1.400	81.1	6.6	3.31	0.73	2.57	18.9	38.7	10.73	9.48	1.13
1.600	89.8	7.9	3.65	1.10	2.52	10.2	54.4	14.11	13.66	0.32
CALC. WHOLE COAL	100.0	12.7	4.72	2.38	2.30					

SAMPLE 33C

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.280	34.5	3.8	3.19	0.38	2.80	65.5	16.8	5.20	3.02	2.13
1.300	43.4	4.2	3.20	0.43	2.76	56.6	18.6	5.51	3.40	2.06
1.400	83.0	7.0	3.45	0.82	2.61	17.0	38.3	9.67	8.37	1.17
1.600	92.4	8.6	3.59	1.02	2.54	7.6	57.7	15.72	15.32	0.19
CALC. WHOLE COAL	100.0	12.3	4.51	2.11	2.36					

SAMPLE 34C

	FLOAT FRACTION					SINK FRACTION				
SP.GRAV.	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S	CUM.WT.	ASH	TOT.S	PYR.S	ORG.S
1.275	23.1	3.8	3.46	0.61	2.83	76.9	13.2	4.83	2.36	2.41
1.300	43.2	4.5	3.50	0.70	2.78	56.8	16.0	5.29	2.91	2.30
1.400	86.9	7.1	3.89	1.16	2.70	13.1	36.7	8.67	7.24	1.22
1.600	93.7	8.2	4.04	1.35	2.65	6.3	53.6	11.62	10.94	0.38
CALC. WHOLE COAL	100.0	11.0	4.51	1.96	2.51					